

What is claimed is:

1. A therapeutic radiation source, comprising:
  - A. a radiation generator assembly, comprising:
    - a. an electron source for emitting electrons to generate an electron beam along a beam path, said electron source including a thermionic cathode having an electron emissive surface, and
    - b. a target positioned in said beam path, said target including means for emitting therapeutic radiation in response to incident accelerated electrons from said electron beam;  
wherein said target is characterized by a non-planar configuration;
  - B. a source of optical radiation; and
  - C. an optical delivery structure having a proximal end and a distal end and adapted for transmitting to said distal end optical radiation generated by said source and incident on said proximal end;  
wherein said optical delivery structure is adapted for directing a beam of said transmitted optical radiation upon a surface of said cathode, said beam of optical radiation having a power level sufficient to heat at least a portion of said surface to an electron emitting temperature so as to cause thermionic emission of electrons from said surface.
2. A therapeutic radiation source according to claim 1, wherein said target comprises:
  - (a) a film made of a substantially x-ray emissive material; and
  - (b) a support structure made of a substantially x-ray transmissive material.



0 3. A therapeutic radiation source according to claim 1, wherein said target includes an intersection edge and at least a first and a second substantially flat surface, each surface including a distal end, each surface extending outward from said intersection edge toward said distal end; and  
wherein said first surface and second surface form an angle with respect to each other.

0 4. A therapeutic radiation source according to claim 1, wherein said target has a substantially conical shape.

5. A therapeutic radiation source according to claim 1, wherein said target has a substantially convex shape.

6. A therapeutic radiation source according to claim 1, wherein said target has a substantially hemispherical shape.

7. A therapeutic radiation source according to claim 1, wherein said target has a substantially spherical shape.

8. A therapeutic radiation source according to claim 1, wherein said film has a thickness of about 1 micron.

9. A therapeutic radiation source according to claim 1, wherein said film is made of a material selected from the group consisting of gold, tungsten, uranium, and molybdenum.

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10. A therapeutic radiation source according to claim 1, wherein said support structure has a length of about 1 mm.

11. A therapeutic radiation source according to claim 1, wherein said support structure is made of an x-ray transmissive material.

12. A therapeutic radiation source according to claim 1, further comprising:  
a substantially rigid housing enclosing said thermionic cathode and said target, wherein said housing defines a substantially evacuated interior region extending along said beam path between an input end and an output end of said housing.

13. A therapeutic radiation source according to claim 1, further comprising a radiation transmissive window at an output end of said housing, wherein therapeutic radiation emitted from said target is directed through said radiation transmissive window.

14. A therapeutic radiation source according to claim 1, wherein said optical delivery structure comprises a fiber optical cable.

15. A therapeutic radiation source according to claim 1, wherein said fiber optical cable has a diameter between about 100 microns to about 200 microns.

16. A therapeutic radiation source according to claim 1, wherein the power required for heating said electron emissive surface of said cathode so as to generate an electron beam forming

a current of about 2 micro amps is between about 0.1 Watt to about 1.0 Watt.

17. A therapeutic radiation source according to claim 1, wherein said optical source is a laser, and wherein said beam of optical radiation is substantially monochromatic and coherent.

18. A therapeutic radiation source according to claim 1, wherein said therapeutic radiation comprises x-rays.

19. A therapeutic radiation source according to claim 1, further including means for providing an accelerating voltage between said electron source and said target element so as to establish an accelerating electric field which acts to accelerate electrons emitted from said electron source toward said target element.

20. A therapeutic radiation source according to claim 19, wherein said means for establishing an accelerating electric field is a power supply.

21. A therapeutic radiation source, comprising:

A. a radiation generator assembly, comprising:

- a. an electron source for emitting electrons to generate an electron beam along a beam path, said electron source including a thermionic cathode having an electron emissive surface, and
- b. a target positioned in said beam path, said target including means for emitting therapeutic radiation in response to incident accelerated electrons from said

electron beam; and

- c. a substantially rigid housing enclosing said thermionic cathode and said target, wherein said housing defines a substantially evacuated interior region extending along said beam path between an input end and an output end of said housing.

B. a source of optical radiation; and

C. optical delivery structure having a proximal end and a distal end and adapted for transmitting to said distal end optical radiation generated by said source and incident on said proximal end, said optical delivery structure being adapted for directing a beam of said transmitted optical radiation upon a surface of said thermionic cathode, wherein said beam of optical radiation has a power level sufficient to heat at least a portion of said surface to an electron emitting temperature so as to cause thermionic emission of electrons from said surface; and wherein said target has a non-planar configuration.

22. A therapeutic radiation source according to claim 1, wherein said x-ray transmissive material is selected from the group consisting of beryllium and boron carbide.